

CLAIMS

WHAT IS CLAIMED:

1. A method, comprising:
5 providing a substrate having a metal layer formed thereabove;
performing a chemical mechanical polishing process on said layer of metal in the
presence of a polishing slurry;
measuring at least a concentration of a material comprising said metal layer in said
polishing slurry used during said polishing process after at least some of said
polishing process has been performed; and
determining a thickness of said layer of metal removed during said polishing process
based upon at least said measured concentration of said material comprising
said metal layer.
- 15 2. The method of claim 1, further comprising adjusting at least one parameter of
said polishing process based upon said determined thickness of said layer of metal removed
during said polishing process.
- 20 3. The method of claim 1, further comprising measuring a volume of said polish-
ing slurry used during said polishing process.
4. The method of claim 3, further comprising calculating a thickness of said layer
of metal removed during said polishing process based upon at least the measured volume of
said polishing slurry used during said polishing operation.

5. The method of claim 3, further comprising calculating a thickness of said layer of metal removed during said polishing process based upon at least the measured volume of said polishing slurry used during said polishing operation and said measured concentration of said material comprising said metal layer.

5

6. The method of claim 1, wherein providing a substrate having a metal layer formed thereabove comprises providing a substrate having a metal layer comprised of at least one of copper, aluminum, and titanium formed thereabove.

7. The method of claim 1, wherein measuring a concentration of a material comprising said metal layer comprises measuring a concentration of a material comprising said metal layer using a concentration monitor.

8. The method of claim 3, wherein measuring a volume of said polishing slurry used during said polishing process comprises measuring a volume of said polishing slurry used during said polishing process using a volumetric meter.

9. The method of claim 1, wherein said step of determining a thickness of said layer of metal removed during said polishing process comprises accessing a model comprised of data correlating said measured concentration of said material comprising said layer of metal and a thickness of a layer of material comprised of the same material as said layer of metal.

10. The method of claim 1, wherein said step of determining a thickness of said layer of metal removed during said polishing process comprises calculating a thickness of

said layer of metal removed during said polishing process based upon at least said measured concentration.

11. A method, comprising:

5 providing a substrate having a metal layer comprised of copper formed thereabove;
performing a chemical mechanical polishing process on said layer of metal in the
presence of a polishing slurry;
measuring at least a concentration of copper in said polishing slurry used during said
polishing process after at least some of said polishing process has been
performed; and
determining a thickness of said layer of metal removed during said polishing process
based upon at least said measured concentration of copper

12. The method of claim 11, further comprising adjusting at least one parameter
of said polishing process based upon said calculated thickness of said layer of metal removed
during said polishing process.

13. The method of claim 11, further comprising measuring a volume of said
polishing slurry used during said polishing process.

14. The method of claim 13, further comprising calculating a thickness of said
layer of metal removed during said polishing process based upon at least the measured
volume of said polishing slurry used during said polishing operation.

15. The method of claim 13, further comprising calculating a thickness of said layer of metal removed during said polishing process based upon at least the measured volume of said polishing slurry used during said polishing operation and said measured concentration of said copper.

5

16. The method of claim 11, wherein measuring a concentration of copper comprises measuring a concentration of copper using a concentration monitor.

17. The method of claim 13, wherein measuring a volume of said polishing slurry used during said polishing process comprises measuring a volume of said polishing slurry used during said polishing process using a volumetric meter.

18. The method of claim 11, wherein said step of determining a thickness of said layer of metal removed during said polishing process comprises accessing a model comprised of data correlating said measured concentration of said material comprising said layer of metal and a thickness of a layer of material comprised of the same material as said layer of metal.

19. The method of claim 11, wherein said step of determining a thickness of said layer of metal removed during said polishing process comprises calculating a thickness of said layer of metal removed during said polishing process based upon at least said measured concentration.

20. A method, comprising:

providing a substrate having a metal layer comprised of copper formed thereabove;

performing a chemical mechanical polishing process on said layer of metal in the
presence of a polishing slurry;
measuring at least a concentration of copper in said polishing slurry used during said
polishing process after at least some of said polishing process has been
performed; and
calculating a thickness of said layer of metal removed during said polishing process
based upon at least said measured concentration of copper.

21. The method of claim 20, further comprising adjusting at least one parameter
of said polishing process based upon said calculated thickness of said layer of metal removed
during said polishing process.

22. The method of claim 20, further comprising measuring a volume of said
polishing slurry used during said polishing process.

23. The method of claim 22, further comprising calculating a thickness of said
layer of metal removed during said polishing process based upon at least the measured
volume of said polishing slurry used during said polishing operation.

24. The method of claim 22, further comprising calculating a thickness of said
layer of metal removed during said polishing process based upon at least the measured
volume of said polishing slurry used during said polishing operation and said measured
concentration of copper.

25. The method of claim 20, wherein measuring a concentration of copper comprises measuring a concentration of copper using a concentration monitor.

26. The method of claim 22, wherein measuring a volume of said polishing slurry used during said polishing process comprises measuring a volume of said polishing slurry used during said polishing process using a volumetric meter.

27. A method, comprising:

providing a substrate having a metal layer comprised of copper formed thereabove;

performing a chemical mechanical polishing process on said layer of metal in the presence of a polishing slurry;

measuring at least a concentration of copper in said polishing slurry used during said polishing process after at least some of said polishing process has been performed; and

determining a thickness of said layer of metal removed during said polishing process by accessing a model comprised of data correlating said measured concentration of copper and a thickness of a layer of copper.

28. The method of claim 27, further comprising adjusting at least one parameter of said polishing process based upon said determined thickness of said layer of metal removed during said polishing process.

29. The method of claim 27, wherein measuring a concentration of copper comprises measuring a concentration of copper using a concentration monitor.

30. A method, comprising:

providing a substrate having a metal layer comprised of copper formed thereabove;
performing a chemical mechanical polishing process on said layer of metal in the
presence of a polishing slurry;

measuring a volume of said polishing slurry used during said polishing process after
at least some of said polishing process has been performed;

measuring a concentration of copper in said measured volume of polishing slurry; and
calculating a thickness of said layer of metal removed during said polishing process

based upon at least said measured volume of polishing slurry and said
measured concentration of copper.

31. The method of claim 30, further comprising adjusting at least one parameter
of said polishing process based upon said calculated thickness of said layer of metal removed
during said polishing process.

32. The method of claim 30, wherein measuring a volume of polishing slurry used
during said polishing process comprises collecting said polishing slurry used during said
polishing process in a reservoir having a known value.

33. The method of claim 30, wherein measuring a concentration of copper
comprises measuring a concentration of copper using a concentration monitor.

34. The method of claim 30, wherein measuring a volume of said polishing slurry
used during said polishing process comprises measuring a volume of said polishing slurry
used during said polishing process using a volumetric meter.

35. A system, comprising:

a chemical mechanical polishing tool for performing a chemical mechanical polishing process on a metal layer in the presence of a polishing slurry;

5 a concentration monitor for measuring a concentration of a material comprising said metal layer in said polishing slurry used during said polishing process after at least some of said polishing process has been performed; and

a controller for receiving said measured concentration and determining a thickness of said layer of metal removed during said polishing process based upon at least said measured concentration of said material comprising said layer of metal.

36. The system of claim 35, wherein said chemical mechanical polishing tool is adapted to perform a polishing operation on at least one wafer.

37. The system of claim 35, wherein said controller is resident on said chemical mechanical polishing tool.

38. The system of claim 35, wherein said controller is a stand-alone device.

20 39. The system of claim 35, further comprising a volumetric meter to measure a volume of said polishing slurry used during said polishing operations.

40. The system of claim 35, wherein said controller is further adapted to determine a thickness of said layer of metal removed during said polishing process based at least upon said measured volume of said polishing slurry.

41. The system of claim 35, wherein said controller is further adapted to determine a thickness of said layer of metal removed during said polishing process based at least upon said measured volume of said polishing slurry and said measured concentration of said material comprising said metal layer in said polishing slurry.

42. The system of claim 35, wherein said controller is further adapted to determine a thickness of said layer of metal removed during said polishing process by accessing a model comprised of data correlating said measured concentration of said material comprising said layer of metal and a thickness of a layer of material comprised of the same material as said layer of metal.

43. A system, comprising:

means for performing a chemical mechanical polishing process on a metal layer in the presence of a polishing slurry;

means for measuring a concentration of a material comprising said metal layer in said polishing slurry used during said polishing process after at least some of said polishing process has been performed; and

controller means for receiving said measured concentration and determining a thickness of said layer of metal removed during said polishing process based upon at least said measured concentration of said material comprising said layer of metal.

44. The system of claim 43, wherein said means for performing a chemical mechanical polishing process is adapted to perform a polishing process on at least one wafer.

45. The system of claim 43, wherein said means for measuring a concentration of a material comprising said metal layer is comprised of a concentration monitor.

5 46. The system of claim 43, wherein said controller means is resident on said chemical mechanical polishing tool.

47. The system of claim 43, wherein said controller means is a stand-alone device.

48. The system of claim 43, further comprising a means for measuring a volume of said polishing slurry used during said polishing operations.

49. The system of claim 43, wherein said controller means is further adapted to determine a thickness of said layer of metal removed during said polishing process based at least upon said measured volume of said polishing slurry.

50. The system of claim 43, wherein said controller means is further adapted to determine a thickness of said layer of metal removed during said polishing process based at least upon said measured volume of said polishing slurry and said measured concentration of said material comprising said metal layer in said polishing slurry.

51. The system of claim 43, wherein said controller means is further adapted to determine a thickness of said layer of metal removed during said polishing process by accessing a model comprised of data correlating said measured concentration of said material

comprising said layer of metal and a thickness of a layer of material comprised of the same material as said layer of metal.